CLAIMS

What is claimed is:

1. A novel process for manufacturing photocatalytic, antibacterial, selfcleaning and sanitizing surfaces on ceramic tiles and other ceramic products by solid state deposition.
2. A process using cold powders of nano-anatase and other ceramic photocatalytic and antibacterial compounds for deposition on a melted or partially melted surface of glazed ceramic tiles and other glazed ceramic products.
3. A process, where the ceramic material for the Deposition is a form of doped or undoped anatase, including nano sized anatase and thermally stable forms.
4. A process where the material for the Deposition is doped or undoped ZnO, including nano sized ZnO.
5. A process, where the substrate for Deposition is a glazed ceramic tile or another glazed ceramic product.
6. A process creating a spotty Deposition of a photocatalytic and/or antibacterial ceramic compound on the surface of the substrate, with a minimal negative impact on gloss and other optical properties of the product (optical interference free Deposition).
7. A process, where relatively cold solid phase powder is deposited on a hot substrate surface and cooled down fast enough to prevent chemical and physical changes of the deposited compound, such as changes in chemical composition, crystal phase and particle size.
8. A process, where the hot substrate surface is melted, partially melted or chemically reacting, having sticky properties and is able to bond the solid phase compound used for the Deposition.
9. A process, where up to 90% of the original substrate surface can be converted into a form of the deposited compound.

10. A process, where the deposited compound on the surface does not significantly change its own chemical composition, crystal phase and particle size.
11. All experiments described in the Examples and derivatives of these examples.
12. A process, where the properties of the surface after deposition described in this invention are a combination of characteristics of the surface layer used for deposition and the deposited compound.
13. A process, where silver, copper, heavy and noble metals possessing antibacterial characteristics and increasing PCA can be introduced either as a part of the dry powder Deposition, or is a separate step, using wet deposition, followed by drying and calcinations, creating additional antibacterial protection.
14. A process, where the deposition is made by shallow impacts of aggregated, agglomerated or micronized powders onto melted or partially melted surfaces and the solid particles melt into this surface on the substrate side, while the chemical composition and crystal phase of the other particle side does not change.

AMENDED CLAIMS

[received by the International Bureau on 08 January 2004 (08.01.04);
original claims 1-14 replaced by amended claims 1-17 (2 pages).]

CLAIMS

What is claimed is:

1. A novel process for manufacturing of photocatalytic, antibacterial, self-cleaning and sanitizing surfaces on ceramic tiles and other ceramic products comprising:

a) creating a sticky surface on ceramic tiles or glazed ceramic products by heating;

b) depositing an active photocatalytic and antibacterial ceramic compound in a powder form on the sticky surface;

c) exposing and bonding the powder to the sticky surface;

d) rapidly cooling the surface with the powder deposition to temperatures under 850°C;

e) cooling the product to the room temperature.

2. A process of claim 1, further comprising removing the unbonded powder from the glazed surface.

3. A process of claim 1, wherein the powder of the active ceramic compound is selected from a group of photocatalytic and antibacterial compounds consisting of metal oxides.

4. A process of claim 3, wherein the metal oxide is TiO_2, ZnO, CuO, Ag_2O, SnO_2 and mixtures thereof.

5. A process of claim 4, wherein the powder of the active ceramic compound is TiO_2 crystal form of undoped or doped anatase, with the average particle size smaller than 100nm.

6. A process of claim 4, wherein the powder for Deposition is doped or undoped TiO_2 crystal form of rutile with the average particle size smaller than 500nm.

7. A process of claim 4, wherein the powder for Deposition is doped or undoped ZnO, with the average particle size smaller than 1 μm.

8. A process of claim 1b), wherein the powder is colder than the sticky surface.

9. A process of claim 1a), 1b) and 1c) wherein the sticky surface for powder deposition is melted, partially melted or chemically reacting and it is able to bond the solid phase ceramic compound used for the Deposition.

10. A process of claim 1d), wherein cooling is fast enough to prevent chemical and physical changes of the chemical composition, crystal phase and particle size of the deposited compound.

11. A process of claim 1, wherein the spotty deposition of the powder of the active ceramic compound covers up to 90% of the glazed surface.

12. A process of claim 10, wherein gloss and other optical properties of the product are not significantly changed by the Deposition.

13. A process of claim 1, wherein the excess of the powder of the active compound does not significantly change its own chemical composition, crystal phase, morphology and particle size during the Deposition and can be recycled.

14. A process of claim 1 further comprising doping the surface with heavy and noble metals possessing antibacterial character and extending the antibacterial properties of the product.

15. A process of claim 14, wherein the metals are selected from the group consisting of silver, copper, zinc and platinum.

16. A process of claim 14, wherein the metals are introduced as a part of the dry powder described in claim 1.

17. A process of claim 14 comprising doping the surface with noble and heavy metals by depositing water soluble salts on the surface received in claim 1e), followed by drying and short calcination at a temperature between about 300°C and about 900°C.